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| 09/922,122 | 08/03/2001 | Hugues Marchand | G&C 30794.79-US-U1 | 7852 |
| 22462 7590 08/05/2009 GATES & COOPER LLP HOWARD HUGHES CENTER 6701 CENTER DRIVE WEST, SUITE 1050 LOS ANGELES, CA 90045 | | | | |
| EXAMINER | | | | |
| SONG, MATTHEW J | | | | |
| ART UNIT | | PAPER NUMBER | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

09/922,122

Applicant(s)

MARCHANT ET AL.

Examiner

MATTHEW J. SONG

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 May 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 4-9, 11-35 and 38 is/are pending in the application.
- 4a) Of the above claim(s) 18-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-9, 11-17, 35 and 38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/C)
- Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-2, 4-9, 15-17, 35, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tischler et al (US 6,765,240) in view of Nagahama et al (US 2005/0054132 A1).

Tischler et al discloses a semiconductor film of M*N formed on a substrate. Tischler et al also discloses the using a silicon substrate (col 4, ln 50-60 and col 8, ln 10-35) and the M*N can be a single crystal material comprising a compositionally graded ternary metal nitride selected from the group consisting of AlGaN and InGaN (col 13, ln 1-5), which clearly suggests a single crystal graded gallium nitride layer having a

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substantially varying composition of a substantially continuous grade from an initial composition to a final composition.

Tischler et al is silent to the graded gallium nitride layer has a net compressive stress.

In a method of forming a nitride semiconductor device, note entire reference, Nagahama et al teaches a when GaN is grown on a SiC substrate, cracks are liable to occur in the GaN layer because the relationship of coefficients of thermal expansion are such that a tensile strain is laid in the in-plane direction on the GaN layer grown on a SiC substrate ([0016]). Nagahama et al also teaches when GaN is grown on a sapphire substrate cracks are not liable to occur in the GaN layer because the relationship of coefficients of thermal expansion is such that a compressive strain is laid in the in-plane direction on the GaN layer grown on the sapphire substrate ([0016]). Nagahama et al also teaches the formation of cracks is suppressed if the thermal expansion coefficient of the layer is smaller than the substrate and compressive strain is laid on the layer ([0017], which clearly suggests compressive strain is desirable to suppress crack formation. Nagahama et al also teaches when a GaN substrate comprising a heterogenous substrate and nitride semiconductor layers is used, the breakage and chipping of the wafer can be prevented and the step of removing the auxiliary substrate can be eliminated and the manufacturing time is shortened ([0026]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tischler et al to form the graded gallium nitride layer to have a compressive strain to suppress crack formation which would allow eliminating the

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substrate removal step, thereby shortening manufacturing time, as taught by Nagahama et al.

Referring to claims 2, 4-9, and 35, the claims are product by process claims and are not limited to the manipulations of the recites steps, only the structure of the implied steps. Even though product-by-process claims are limited by and defined by the process, determination of the patentability is based on the product itself. If the product in the product by process claim is the same or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113). The combination of Tischler et al and Nagahama et al discloses a semiconductor film comprising all of the claimed structural features of the product.

Referring to claim 15, the combination of Tischler et al and Nagahama et al teaches forming microelectronic structures on the M*N, which include LEDS, lasers, transistors etc., which suggests an additional layer disposed on the graded layer.

Referring to claim 16-17, the combination of Tischler et al and Nagahama et al teaches the M*N material may be doped with Si and the M*N material may be an AlGaInN compositionally graded compound ('240 col 12, ln 30-45 and col 9, ln 1-15), this reads on applicant's other element is silicon or indium.

Referring to claim 38, the combination of Tischler et al and Nagahama et al teaches the GaN material has no cracks; therefore suggests a layer having a net stress below a stress required for crack generation.

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3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tischler et al (US 6,765,240) in view of Nagahama et al (US 2005/0054132 A1), as applied to claims 1-2, 4-9, 15-17, 35 and 38 above, and further in view of Redwing et al (US 5,874,747).

The combination of Tischler et al and Nagahama et al teaches all of the limitations of claim 11, as discussed previously, except the combination of Tischler et al and Nagahama et al does not teach the initial composition comprises substantially at least 20% aluminum composition.

In a method of making gallium nitride, note entire reference, Redwing et al teaches the quality of a GaN layer grown on a lattice mismatched substrate such as SiC or

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Si is greatly improved when a buffer or transition layer is grown on the substrate prior to growth of the GaN layer (col 4, ln 60-65). Redwing et al also teaches a buffer structure which eliminates cracking comprising a compositionally graded (Al,Ga)N buffer layer between a substrate and a GaN epi-layer. Redwing et al also teaches using a graded buffer layer gradually varies the lattice constant and thermal expansion coefficient from that of AlN to that of GaN (col 18, ln 35 to col 19, ln 25). Redwing et al also teaches using an AlGaIn buffer where the Al composition is graded from 1 at the substrate interface to 0 at the GaN interface (col 18, ln 60 to col 19, 10 and col 24, ln 55-67) to eliminate cracking of GaN epi-layers, this clearly suggests applicant's initial composition is at least 20% aluminum composition and the final composition comprises substantially less than a 20% aluminum composition.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tischler et al and Nagahama et al by using an initial composition rich in Al and a final composition with no Al, as suggested by Redwing et al, to produce a GaN layer free of cracking by reducing lattice mismatch using a graded buffer layer.

Referring to claims 12-14, the combination of Tischler et al, Nagahama et al and Redwing et al teaches an initial composition of AlN and a final composition of GaN, this clearly suggests applicant's initial composition is at least 20% aluminum composition and the final composition comprises substantially less than a 20% aluminum composition.

Response to Arguments

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5. Applicant's arguments with respect to claims 1, 2, 4-9, 11-17, 35 and 38 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

/Matthew J Song/
Examiner, Art Unit 1792

Art Unit: 1792

/Michael Kornakov/

Supervisory Patent Examiner, Art Unit 1792